Sustainability Management Accounting System (SMAS): Towards a Conceptual Design for the Manufacturing Industry

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Abstract
The study reported in this paper aims to identify an effective management accounting system using sustainability accounting concept for environmental and social cost measurement thus adding value to organizations. The motivation for undertaking this research is driven by the current practice of activity based costing (ABC), which has not identified and allocated costs of environment and social impacts to a single production activity. This results in cost accounting information inaccuracies when preparing environmental and social performance disclosures for internal management decisions as well as external disclosures. This study therefore develops a conceptual model for a Sustainability Management Accounting System (SMAS) to improve the identification and measurement of environmental and social impact costs. A SMAS also provides sustainable organizations with a way to enhance cost allocation and analysis efficiently thus creating more accurate cost accounting information for management decisions and reporting disclosure purposes. The paper describes preliminary work undertaken to date. It would appear that most Australian firms are rarely reporting their environmental performance while social indicators become greatest concern to disclose corporate social responsibility of organizations. Further, the results of quantitative data analysis will be used to identify an effective management accounting of sustainable organizations while supporting the development of SMAS conceptual model.

Keywords-component: activity based costing (ABC), environmental management accounting (EMA), social management accounting (SMA), sustainability management accounting system (SMAS), environmental cost, social cost.
1. INTRODUCTION

An effective management accounting framework for environmental and social cost measurement facilitates manufacturing companies to accurately create cost accounting information for internal management decision processes. It can also support companies to incorporate economic, social, and environmental information when disclosing through the form of a triple bottom line report (Berkel 2003; Gadenne & Zaman 2002; Hubbard 2009). As a result, environmental costs need to be captured from both internal and external organizations while social expenditures need to be considered to collect as social costs. Companies need to appropriately identify and measure these costs before allocating to a single production activity to possibly evaluate reductions in and controls of these costs and their contaminants (wastes, solids, and/or emissions) (IFAC 2005; UNDSD 2001). In doing so, companies not only reduce negative impacts on the environment but also improve quality of society as a whole (Nachtmann & Al-Rifai 2004). Companies become more environmentally and socially aware organizations while adding value as sustainable organizations to ensure corporate sustainability is achieved in the eye of stakeholders and marketplaces (Gale 2005; Jacob 1994; Sikdar 2007).

However, as environmental costs have been treated as overheads by traditional management accounting, this has resulted in these costs have been hidden among productions and/or service processes (IFAC 2005; UNDSD 2001). Meanwhile, social costs have been ignored as a measure to improve quality of life of employees, society and/or some extent of environment, as they are claimed as private costs (Hazilla & Kopp 1990). This results in cost information inaccuracy when employing to enhance environment and social internal decision making. Companies are also not able to support stakeholders’ demands based on imprecise environmental and social performance disclosers (Berkel 2003; Gadenne & Zaman 2002; Gray 2006). Apart from that, a holistic system of a sustainability accounting concept combing
environmental management accounting and social management accounting has not been widely introduced to organizations for environmental and social costs identification and measurement (Gadenne & Zaman 2002; Spence 2009). Thus, an affective management accounting system for environmental and social costs is needed by companies to enhance environmental and social costs dimensions in order to fully cost more accurately to prepare sustainable development reporting (Gray 2006; Gray et al. 2001).

Consequently, this paper describes the development of a conceptual model of a Sustainability Management Accounting System (SMAS) as an effective management accounting for sustainable organizations. A sustainability management accounting system (SMAS) refers to sustainability and management accounting concepts and practices dealing with environmental and social issues. Sustainability has been accepted as an integration of three performance – economic, social, and ecological systems (environment) that companies are required to sustain development (Dixon & Fallon 1989). The main areas of development are related to human, social, economic, and the environment (Goodland 2002) that companies need to disclose in the form of a triple bottom line report (Berkel 2003). Therefore a SMAS identified by this study aims to capture more accurate cost accounting data of environment and social impacts while allocating to a single products. Environmental management accounting (EMA) and social management accounting (SMA) concepts and practices are integrated in a design of SMAS to help in cost measurement and identification in order while separating these costs from overheads. An activity based costing (ABC) approach is expanded to help in cost allocation and analysis using costs drivers or cost centres to assign these costs to a single production activity. This results in companies effectively identify and measure costs of environment and social impacts while creating cost accounting accuracies to support external disclosures and to enhance internal management decisions. By having a SMAS, companies fully cost products and services while providing external disclosures through triple bottom line
and/or corporate social responsibility (CSR) reporting to add value as sustainable organizations in the eyes of stakeholders and marketplaces (Berkel 2003; Gadenne & Zaman 2002). In the following section, relevant literature is provided to support cost measurement and identification of environment and social impacts as well as identifying key terms to inform the development in a design of a SMAS.

2. RELEVANT LITURATURE

As economic, environmental and social performance is required to incorporate in financial disclosures through the form of a triple bottom line, the need of companies is to provide more accurate cost accounting data of environment and social impacts (Berkel 2003; Carbon Trust 2005; Gadenne & Zaman 2002; Hubbard 2009). This report can help reduce stakeholders’ pressures on the development of economic, social, and environmental performance while improving internal decision-making on management of and reductions in these costs and contaminants (Berkel 2003; Gadenne & Zaman 2002; Gale 2005). Companies can create better ‘green’ and ‘social’ qualities of products and services while gaining greater benefits from higher economic performance in the long-term (Schaltegger & Wagner 2006). This study therefore fuses three theories - deep ecology theory, Marx’s labour theory of value, and stakeholder theories to examine where ethical and moral obligations in providing cost information (Donaldson & Preston 1995; Drengson & Inoue 1995; Shaw 2009; Yee et al. 2008) of environmental and social impacts.

2.1 Theoretical perspectives

Deep ecology theory is applied in the theoretical design of SMAS using shallow ecology to explain ethical and moral responsibilities of companies to measure environmental costs and to manage uses of resources, energy, and water (Devall & Sessions 1985; Jacob 1994). Meanwhile, deep ecology helps explain why measuring reductions of emissions and
wastes would help to reduce negative impacts on the environment and society (Jacob 1994). Deep ecology theory was developed by Naess in 1973 to explain improvement in qualities of humans and the environment by reducing environmental pollution and avoiding extractions of natural resources (Devall & Sessions 1985; Drengson & Inoue 1995). Naess was also trying to deeply question how best ecological patterns need to be maintained in order to improve human lives, environment, and natural systems (Devall & Sessions 1985). In addition, the theory also indicates that the movement of shallow and deep ecological management approaches seek questioning as to where ethical and moral actions are taking responsibilities to reduce negative impacts on society and the environment (Barrow 1999; Drengson & Inoue 1995). Thus, by applying deep ecology theory, this helps examine identification of environmental cost information when providing environmental performance disclosures to support stakeholders’ concerns. However, deep ecology appears to have not been used before to examine the identification of social issues (Jacob 1994). This research also uses Marx’s labour theory of value to explain measurement of social impact costs.

*Marx’s labour theory of value* helps explain measurement of social impact costs while creating surplus value or maximizing profits in selling large quantities of products in markets (Jasch & Stasiškienė 2005). Karl Marx developed a concept of surplus-value(s) to explain a company’s interest in measuring costs of production processes while producing large quantities to support high consumers’ consumptions in markets (Little 1986). To realize the surplus-value contained in products (under capitalism), the products must be sold in the market at a price reflecting the labour time of average (in terms of efficiency) producers (Marx 1976, 1978, 1981). Therefore, both workers and capitalist business owners are concerned with efficient production, training and skilling of the workforce, and selling products demanded by consumers (Marx 1976, 1978, 1981). Otherwise the surplus-value produced in the factory by workers cannot be realized, and even part or all of the original capital invested in production
maybe wasted (Marx 1981; Yee et al. 2008). Thus, in employing Marx’s labour theory of value helps explain measurement of social impact costs while creating surplus value or maximizing profits in selling large quantities of products in markets (Jasch & Stasiškienė 2005). Companies also need to provide cost information for social internal decision making and stakeholders’ concerns. In doing so, stakeholder theory is employed to examine collecting more cost information for both environmental and social impacts.

Stakeholder theory helps in the identification of a company’s stakeholders and explains the ethical and moral obligations of management to consider the interests of these stakeholders (Freeman 1984; Freeman & Reed 1983). This research applies stakeholder theory to explain associating disclosure with economic and social performance by combing three dimensions – stakeholder power, strategic posture, and economic performance (Ullmann 1985). Thus, in the design of SMAS, stakeholder theory helps determine key concerns and objectives of stakeholders while explaining ethical and moral obligations in measuring environmental and social costs. These concerns are translated into measures, which in turn is incorporated as system characteristics for data inputs required for reporting and internal decision making. This can create more accurate cost information supporting environment and social internal decision making and external disclosures. However, as there is considerable disagreement in the literature on definitions, this study reviewed relevant literature of terminologies used to support the focus of the study in order to define key terms of accounting and its expanding roles for a developed SMAS.

Consequently, in the designed SMAS, these fused theories help in creating more accurate cost information for internal management decisions thus fully costing products and/or services. Companies can also prepare financial disclosures to create better relationship with their stakeholders when disclosing through the form of a triple bottom line and/or corporate social responsibility (CSR). However, there is some confusion in the literature on definitions in
relation to terminologies used to support the focus of the study. This study therefore provides relevant literature to define key terms of accounting and its expanding roles for a developed SMAS.

**Accounting and expanding roles**

### 2.2.1 Traditional accounting

Traditional accounting has two components which are financial accounting (FA) and management accounting (MA). Financial accounting helps in providing companies’ disclosures when reporting financial performance of organizations to guide decision making on investments and performance management as well as supporting stakeholders’ information needs (Holland 2004; IFAC 2005; UNDSD 2001). Meanwhile, management accounting is widely used to measure cost of inputs (materials and labour) while treating all other costs as overheads. For environmental costs, management accounting has historically treated these as overheads (Hill, McAulay & Wilkinson 2006) using activity based costing (ABC) approach for cost allocation and cost drivers. As ABC has not (to date) separately identified the costs associated with environmental and social impacts. This results in ABC recognizes these costs as overheads. Thus they are hidden among other production and service processes (IFAC 2005; Milne 1996; UNDSD 2001). Companies are now having difficulties in measuring (for example) reductions and control of environmental costs and contaminants (Bose 2006; Gale 2005; IFAC 2005; Pramanik, Shil & Das 2007; Qian & Burritt 2007; UNDSD 2001). As a result, companies are not able to fully cost for setting correct prices of products and services (Englund & Gerdin 2008; Lamberton 2005; The Sigma Project 2003). Thus, extending the application of the ABC approach to separately identify environmental and social impact costs from overheads before allocating to individual product costs is appropriate for this study (Căpusneanu 2008; IFAC 2005; Sendroiu et al. 2006). This can create more accurate cost
information to support internal decision-making and flow on to external reporting and disclosures as they then incorporate sustainability accounting concept.

2.2.2 Sustainability accounting (SA)

Sustainability accounting is a new approach to accounting and reporting to facilitate companies’ developments in three dimensions – economic, social, and environment (Ball 2002; Milne 1996). Sustainability accounting has recently supported disclosures using a triple bottom line report in order to improve internal decision making and to inform stakeholders (Ball 2002; Bennett, Bouma & Wolteres 2002; Taplin, Bent & Aeron-Thomas 2006). A number of current studies, (e.g. Lamberton 2005; Schaltegger & Wagner 2006; Taplin, Bent & Aeron-Thomas 2006), have examined sustainability accounting in terms of physical and monetary measurement to improve financial management. Nonetheless, Gray (2006) pointed out that sustainability accounting should incorporate improvements in social and environmental reporting as external disclosures in order to create shareholder value for sustainable organizations. Furthermore, sustainability accounting provides a company with measurement of all costs so full cost accounting is implemented to support internal and external disclosures through sustainability reporting and corporate social responsibility (CSR) reporting (ICAEW 2004; Lamberton 2005; The Sigma Project 2003). As a consequence, the sustainability accounting concept is appropriate for this study to support a developed SMAS, as it is concerned with environmental and social cost measurement for disclosures of environmental and social performance. In a design of SMAS, sustainability accounting involving in environmental accounting and social accounting concepts is considered using environmental management accounting and social management accounting to support the theoretical framework of a SMAS.

2.2.3 Environmental accounting
Environmental accounting (EA) helps evaluating internal and external costs of the environment from production and service processes while providing environmental performance reporting for management decision on future production (The Sigma Project 2003; UNDSD 2001). Burritt and Saka (2006) claimed that EA has been employed as a business tool to provide financial reports and to manage business performance including environmental costs. Environmental accounting is also a key concept that supports decision making in cost analysis and evaluation of environmental costs while allocating costs correctly to products (EPA 1995; IFAC 2005; The Sigma Project 2003). Environmental accounting is made up of environment financial accounting (EFA) and environmental management accounting (EMA). EFA focuses on providing environmental disclosures to external stakeholders (governments, shareholders etc.) (Burritt & Saka 2006). On the other hand, EMA is used to provide environmental costs information to support internal decision making (IFAC 2005; Bent and Richardsen 2003’ cited in Pittman & Wilhelm 2007; The Sigma Project 2003). By UNDSD (2001), it was mentioned that EMA aims to reduce negative impacts on the environment while improving material efficiency (thus adding value to an organization). EMA is mainly measured in both physical units such as materials, energy, water and wastes, and monetary units such as environmental costs, earning and savings (UNDSD 2001).

Environmental management accounting practices (EMA) were uncovered by Gadenne and Zaman (2002) in Australian companies as well as accountants’ perceptions in providing EMA information for reporting purposes. Claims were made by Gadenne and Zaman (2002) that Australian companies appeared to develop business strategies to meet the requirements of socially and environmentally sensitive organizations. However, they identified the need for environmental costs recording using ABC to be integrated in financial reports as well as a need to develop appropriate EMA systems (Gadenne & Zaman 2002). In discovering the
relationships between environmental performance and economic performance of an electricity company in the United States, Burnett and Hansen (2008) found that decreasing pollution enabled the company to create eco-efficiency. Furthermore, they found that it is better if the implementation of environmental accounting included an environmental management accounting systems (Burnett & Hansen 2008). This enables companies to measure environmental costs from unit inputs (raw materials, energy, and water) as well as non-product outputs (wastes and emissions) (Gale 2005), while evaluating reductions of these costs and contaminants (IFAC 2005).

Thus, by employing EMA concepts and practices, companies can identify and measure environment costs and allocate to the individual product costs while providing more accurate information of these costs (Burritt, Herzig & Tadeo 2009). Companies can also improve environmental performance (UNDSD 2001) while promoting themselves as environmentally aware organizations (Burritt, Herzig & Tadeo 2009). Essentially, environmental cost information is able to support business decision making in managing resources by recording the use and flows in physical (resources, energy, and water) and monetary (financial, cost savings, and earnings) units (Burritt, Herzig & Tadeo 2009). This study therefore considered environmental management accounting (EMA) concepts and practices as appropriate for the development of a SMAS conceptual model. EMA is applied to identify costs of environmental impacts, use and flows of resources, energy, and water as well as to measure reductions of contaminants. EMA records environmental costs information more accurately to support disclosure of environmental performance but currently does not cover social issues (IFAC 2005), which is key contribution of this study. Therefore the study integrates social management accounting (part of social accounting approach) into the development of a SMAS. This may assist companies to become more involved in sustainability management accounting (Jasch & Stasiškienė 2005).
2.2.4 Social accounting

Social accounting consists of social financial accounting and social management accounting and is concerned with improvements in negative impacts on society, humanity, and (to some extent) the environment. Social financial accounting (SFA) provides companies with information for corporate social responsibility reporting (CSR) to improve external reporting of social costs and provide information on significant concerns to stakeholders (Cullen & Whelan 2006; Richmond, Mook & Quarter 2003). Social management accounting (SMA) facilitates companies’ recording and measurement of social costs for internal decision making and supports disclosures of social performance. However, social costs have not been measured much because they are sometimes recorded as a company’s overheads or other expenditures rather than as costs of products (Hazilla & Kopp 1990) if at all. As social costs have historically been ignored by traditional management accounting (using using ABC to identify and allocate to product costs). This has resulted in companies not using social accounting to improve their social performance (Mobley 1970). Thus, disclosers on social performance in the form of corporate social responsibility (CSR) reports have become more complex as costs of social impacts have recently been captured (Tinker, Lehman & Neimark 1991).

Pyatt and Roe (1977) developed a social accounting matrix (SAM) framework to improve the whole area of wage rates in Sri Lanka, they found that employing SAM to improve qualities of life of employees and labourers in Sri Lanka was successful as a new way to develop economic performance. However, SAM did not include development of social performance (Quarter & Richmond 2001). Consequently western organizations have disagreed on the ability of social accounting to reduce social impacts to support stakeholders’ concerns (Tinker & Gray 2003). In addition, social accounting has not been successfully
employed by companies as it is seen purely as raising production costs. Thus a new conceptual model or framework for accounting for social costs is needed (Mook, Richmond & Quarter 2003). The proposed SMAS conceptual model therefore should integrate economic and social performances to add value to enhance sustainability of organizations (Mook, Richmond & Quarter 2003). Apart from that, due to increased concerns of stakeholders, companies are being pushed to improve qualities of society, humans, employees, and the environment by measuring social costs in order to support disclosure of social performance (Geibler et al. 2006). In doing so, companies can create better ‘green’ and ‘social’ qualities of products and services while gaining greater benefits from higher economic performance in the long-term (Sendroiu et al. 2006). This also improves social internal decision making (Borga et al. 2009; Jasch & Stasiškiene 2005). Spence (2009) also suggested that further study should be undertaken in social accounting to consider incorporating social impacts of organizations to add value to their social and economic performance. Combining environmental and social issues could go a long way to improving accounting’s approach to these concerns (Gray 2002). If social accounting could be developed and incorporated into an accounting framework or model, it could assist companies to become more socially and environmentally aware organizations (Gray 2002).

As a consequence, social management accounting (SMA) should be applied in measuring social impact costs which are related to improvements for society, employees, humanity, and the environment. This would provide companies with a way to create more accurately cost information to support internal decision-making and disclosures of social performance. Companies could also become more socially and environmentally aware organizations while creating positive reputations as ‘green and socially responsible producers’ in the eyes of stakeholders and market places. As a result, environmental management accounting, social management accounting, and activity based costing concepts and approaches become key
motivators for this study while underpinning the theoretical framework of a Sustainability Management Accounting System (SMAS) (Figure 1).

2.3 Gaps in the literature

Based on the literature review, it is purported that there was no complete a holistic model identified that contained the necessary characteristics of a proposed SMAS. Various points of view in the literature (e.g. Berkel 2003; Lamberton 2005; Taplin, Bent & Aeron-Thomas 2006) promote the ideas that sustainability accounting is a significant accounting approach and organizations can adopt it to help make internal and external decisions when managing environmental costs. Activity based costing (ABC) as currently practiced successfully identifies and allocates both direct and indirect costs to individual costs of products; however ABC recognizes environmental costs as overheads (in the main) while having difficulty in measuring reductions of these costs and contaminants (Beer & Friend 2005; Bose 2006; Gale 2005; IFAC 2005; Qian & Burritt 2007; UNDSD 2001). Thus ABC needs to be further developed (within the proposed conceptual model) in order to more accurately measure cost (and quality) information on the environment (Gadenne & Zaman 2002; Hubbard 2009; Nachtmann & Al-Rifai 2004). Although, environmental management accounting is an appropriate accounting tool designed for environmental costs management (Burnett & Hansen 2008; Burritt & Saka 2006; Sendroiu et al. 2006), it does not incorporate social impact costs which are becoming significant concerns for stakeholders and the public (IFAC 2005). This results in social costs being ignored but if measured could significantly cause increases in production costs (Hazilla & Kopp 1990; Mook, Richmond & Quarter 2003).

To fill these gaps, this study proposes to develop a conceptual model for a Sustainability Management Accounting System (SMAS) into a holistic system combining environmental management accounting (EMA) and social management accounting (SMA) to help in the
identification and measurement of environmental and social impact costs. SMAS will also apply an **activity based costing (ABC) approach** to help cost analysis and allocation or cost drivers, as suggested by previous studies e.g. (Gadenne & Zaman 2002; Hubbard 2009; Nachtmann & Al-Rifai 2004; Sendriu et al. 2006; Snoo 2006). As these concepts are not widely explored in the literature, particularly in relation to social performance, an integration of EMA and SMA within a SMAS could fill part of the gap to help in cost identification and measurement. In the meantime, applying activity based costing (ABC) concepts in relation to allocating cost of environmental and social costs to a single product has not been completely successful. Additionally, **environmental costs** need to be separately identified and allocated to individual costs of products in order to expose them rather than being concealed in overheads while measuring reductions of these costs and contaminants (benefits). Meanwhile, **social impact costs** need to be measured in order to develop social performance reporting addressing significant concerns of companies’ stakeholders. Companies are now seeking appropriate accounting approaches and systems to relate existing financial reports to **triple bottom line reporting** to more accurately and fully disclose social and environment performance to interested stakeholders while supporting **internal decision making**.

![Figure 1. Accounting concepts underlying the Sustainability Management Accounting System (SMAS)](image)

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3. RESEARCH DESIGN

3.1 Research questions and propositions

To attempt to fill the key gaps identified from the literature, this study posed one main research question. This was to investigating system characteristics within companies that could be employed for environmental and social management decisions. System characteristics identified by this study as full cost accounting that could fully cost to allocate to appropriate production activity. As a full cost accounting aims at collecting costs from external and internal organizations (Bebbington et al. 2001), the system characteristics could be able to capture full costs of products including environment and social impacts. The systems could also allocate cost information to a single production activity using cost analysis and cost drivers of activity based costing approach. This could support companies to successfully improve business decision-making and preparing economic, social, and environmental performance disclosures (Englund & Gerdin 2008; The Sigma Project 2003). In addition, without a holistic system this is difficult to accomplish. In order to be able to conceptualise an information system, system characteristics need to be identified and evaluated so that the most appropriate characteristics can be built into a SMAS. This would give more realistic costs on which to make decisions as the products or services could be more fully costed. To develop the conceptual model for a SMAS, it is necessary to enunciate the systems characteristics required that meet the informational needs of sustainable organizations drawing on best environmental and social management practices while being consistent with accounting concepts. Thus the main research question solicits these system characteristics for a SMAS.

RQ1: What system characteristics could companies employ in their sustainability management accounting systems to meet the needs of EMA and SMA practices while adding sustainable value to organization?

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This study seeks to identify a set of system characteristics that could separately identify costs of environment (rather than as overheads) while measuring reductions of these costs and contaminants (IFAC 2005; Snoo 2006). Also the system characteristics identified could measure social impact costs as separately identifiable expenditures of organizations (Hazilla & Kopp 1990) to capture full costs of products and provide cost information for internal decision making (Bebbington et al. 2001). Companies need to provide environmental and social impact costs accounting to create more precise external disclosures (Gadenne & Zaman 2002; Gray et al. 2001). Nonetheless, as environmental and social costs have been identified as overhead expenditures by traditional management accounting, this creates inaccuracy in cost accounting data for environment and social impacts when incorporated in sustainable development reporting (Berkel 2003; Gadenne & Zaman 2002; Gray 2006). As a consequence, companies may intend to change their management accounting systems to successfully manage cost reductions and emissions abatement. These characteristics capture data on metrics that are identified as environmental and social management accounting best practices. In order to arrive at the set of best practice characteristics, research sub questions need to be answered as follow.

**SR1:** To what extent do current accounting systems capture and report environmental costs to support internal decision making for reducing emissions and wastes?

**SR2:** How are companies intending to change their accounting systems to meet environment and social internal decision making needs that will support future reporting requirements?

**SR3:** To what extent is world best practice in environment and social accounting systems and reporting being adopted by manufacturing companies in Australia?

Answers to these research sub questions solicit current and future practices as to the characteristics of an information system and whether Australian manufacturing companies have adopted world’s best practice. This study posed four propositions that focus on
appropriateness of, and improvements in, employing systems characteristics solicited and comparing these characteristics with Australian firms that have adopted best practice.

P1: Best practice companies indentify costs of environment and social impacts as well as measure reductions of contaminants to reduce negative impacts on humans, society, employees and the environment.

P2: Best practice companies more accurately provide environmental and social costs information for internal decision making and to support external reporting disclosures.

P3: A SMAS provides best practice companies with an enhanced environmental and social costs management system to improve internal decision making and to support stakeholders’ and public concerns.

P4: A SMAS provides best practice companies with a mechanism to add value in economic, social, and environment areas of performance.

Best practice companies employ system characteristics of sustainability accounting concepts to separately identify environmental costs from overhead expenditures before allocating to a single product. In doing so, companies are able to measure reductions in these costs as well as resources, wastes, solids, and emissions in physical and monetary units. Also, social costs are measured and controlled to reduce negative impacts on society, employees, and the environment. Best practices companies are able to provide more accurate cost information to enhance environment and social internal decision-making and to create more precise external reporting. In addition, companies are enabled to meet their reporting obligations of energy consumptions and emission abatement under National Greenhouse and Energy Reporting (NGER) requirements and Global Reporting Initiative (GRI).

As a consequence, system characteristics of best practice companies were employed to support the development of a sustainability management accounting system (SMAS) conceptual model. A SMAS could provide companies with an accounting system to continue improvements in environmental and social cost identification and. By having a SMAS, companies are more concerned about reducing negative impacts on the environment and
Companies are now able to provide triple bottom line reporting when disclosing the development of economic, social, and environmental performance to add value as sustainable organizations. In the following section, the theoretical framework developed to underpin this investigation as the starting point of a SMAS conceptual model.

3.2 Theoretical framework

The study sought to identify appropriate system characteristics of sustainability accounting that could be employed by companies from different manufacturing sectors. Thus, Figure 2 consolidates the appropriate literature into an integrated theoretical framework as the starting point for this study. Firstly, Australian manufacturing companies could employ system characteristics of sustainability accounting concepts to identify and measure environmental costs from physical inputs (quantities) such as resource extractions, energy, fuels, oils, and/or chemical (upstream) and those arising as non-product outputs such as wastes, solids, and emissions (downstream) (Gale 2005; IFAC 2005; Qian & Burritt 2007; UNDSD 2001). Companies could also measure social costs from product responsibilities and improvements in society, humans, and employees which may cause increases in total costs of products (Gray 2006; Jasch & Stasiškienė 2005; Mook, Richmond & Quarter 2003; Pittman & Wilhelm 2007). In doing so, cost information of environmental and social impacts could be used to successfully enhance business management decisions as well as supporting financial disclosures (Berkel 2003; Gadenne & Zaman 2002; Hubbard 2009; Lamberton 2005; Richmond, Mook & Quarter 2003). At this stage, of the study, system characteristics will be identified from concepts contained in environmental management accounting (EMA) and social management accounting (SMA) that are currently used or to be used. The most appropriate system characteristics of sustainability accounting will be extended and drawn...
from best management accounting practices identified by this study to be utilized in the conceptual model of a SMAS.

Secondly, best practice companies identifying and measuring costs of environment and social impacts from internal and external (suppliers and customers) organizations provide cost accounting data to enhance their management decision and financial disclosures (Bartolomeo et al. 2000; Burritt & Saka 2006; IFAC 2005; Sendroiu et al. 2006), as required by environmental management accounting (EMA) concepts (IFAC 2005; UNDSD 2001). Deep ecology will be employed to examine the full extent of measuring reductions in physical inputs (materials, energy, and water) to possibly reduce production costs and contaminants (emissions and wastes) (Barrow 1999). Meanwhile, to measure social costs, companies can identify expenditures for the development of social performance in relation to the quality of employees, society, and green environment (Mook, Richmond & Quarter 2003; Richmond, Mook & Quarter 2003). Based on social management accounting (SMA) concepts, companies can capture costs of social impacts to support disclosures using SMAS rather than being buried in overheads (Gray 2006; Gray et al. 2001). Marx’s labour theory of value will be applied to help identify costs relating to improvements in skills, knowledge, and qualities of employees while maximizing profits from higher consumption (Marx 1874 cited in Keen 2001; Little 1986; Marx 1978). This could help companies to create higher profits when products are sold in a larger volume in marketplaces (Jasch & Stasiškienė 2005). As a consequence, companies collect environmental and social impact costs to fully cost products while allocating to appropriate production activities or to incorporate these costs individual products or cost centres (activities) by expanding on activity based costing (ABC) application (Neumann et al. 2004).

An expanded ABC could help in the development of cost analysis and allocation while more accurately creating cost information to measure production costs of activities as well as
reductions in contaminants and control costs (Armstrong 2006; Căpusneanu 2008; Northrup 2004; Sendroiu et al. 2006). Companies can then employ cost information of environmental and social impact to enhance management decisions while providing disclosures to support stakeholders’ demands (Nachtmann & Al-Rifai 2004). Stakeholder theory is applied in the framework to examine ethical and moral obligations to provide cost accounting data to disclose environmental and social performance in order to add value to sustainable organizations in the eyes of stakeholders (Freeman 1984; Freeman & Reed 1983). In doing so, a SMAS could track and report timing of impacts that are related to movements in stocks and flows of product/services to disclose costs and benefits of operational performance to stakeholders. SMAS could effectively manage timing impacts in changing value of stock and flows of materials in production processes, which may have significant impacts on costs and benefits when tracking on economic, social, and environmental performance disclosures (The Sigma Project 2003). Thus, the measurement of environmental and social costs need to be more accurate when providing cost information to support financial reports and disclosure of environment and social performance (IFAC 2005; The Sigma Project 2003; UNDSD 2001).

Finally, the SMAS theoretical framework provides companies with a way to disclose these three areas of performance through integrated triple bottom line reporting to stakeholders and the public (Borga et al. 2009; Schaltegger & Wagner 2006; Sikdar 2007). By incorporating three fused theories in the theoretical framework, it supports a SMAS conceptual model to fully collect direct costs from materials and labour and indirect costs of overheads as well as social and environment costs (Bebbington et al. 2001; ICAEW 2004; Lamberton 2005). This meets the requirement of sustainability accounting concepts and practices for enhancement of management decisions and environmental and social disclosures (Goodland 2002; Gray 2006; Jasch & Stasiškienė 2005). Companies could create sustainable value chains by managing the three areas of economic, social, and environmental performance.
(Ball 2004; Berkel 2003; Lamberton 2005; Taplin, Bent & Aeron-Thomas 2006; Wahaab 2003). Figure 3-1 illustrates the theoretical framework that is the starting point for the development of a sustainability management accounting conceptual model.

4. RESEARCH METHODOLOGY

4.1 Approach

This study applies mixed methods combining quantitative and qualitative approaches to collect and analyse data using triangulation for credibility, thus avoiding social bias and building stronger results (Creswell 2009; Gorard 2004; Neuman 2006). As an exploratory study, this study employs a quantitative survey to identify system characteristics of sustainability accounting that are used and are intended to be employed by companies for social and environmental cost measurement. The results of the survey are used to compare with an analysis of management accounting best practice using qualitative methods. Meanwhile, a qualitative approach (case studies) are used to investigate management accounting practices and system characteristics of companies from different manufacturing sectors identified (from the survey) as adopting best practice.
4.2 Sample and data collection

To select a sample group, this study employed simple random sampling to select 1,000 Australian manufacturing companies from five sectors (two-hundred from each sector) including paper and furniture products, machinery and equipment, constructions, automobile and metal products, and mining and chemical industries (PricewaterhouseCoopers 2009) to be surveyed. Meanwhile, the companies studied were selected by utilizing a purposive sampling method. Thus, manufacturing companies that apply management accounting best practice to measure costs of environment and social impacts as well as evaluate reductions of these costs and impacts were targeted. The purposive sampling method assisted this study to select appropriate cases for investigation to gain a fuller understanding of best practices used among sectoral groups (Neuman 2006; Patton 1990; Yin 2009). Management accountants dealing with environmental and social issues were appropriately targeted for data collection.

4.3 Data collection

Quantitative research methods were employed to survey 1,000 Australian manufacturing companies. A set of questions was provided using environmental and social performance indicators from Sustainability Reporting Guidelines by GRI (2006) to investigate what characteristics of sustainability accounting systems are used by organizations for environmental and social cost measurement and identification. Chief accountants, controllers, chief financial officers, and management accountants dealing with environmental issues (Gadenne & Zaman 2002) were requested to complete a survey questionnaire. The questionnaires solicited current practices and system characteristics which are being employed
as well as respondents’ attitudes, opinions, and points of views as to what system characteristics should be incorporated into a SMAS for a manufacturing company and their future intentions to incorporate characteristics into their systems. Following the survey, quantitative data will be gathered from fifteen companies from the same sectors used for the survey using interviews of management accountants to gain a richer understanding of environmental and social cost measurement and identification.

5. PRELIMINARY DATA ANALYSIS

Based on a small sample from respondents this section describes some preliminary analysis of quantitative data received to date of writing this paper. The quantitative survey that responded to sub questions, SR1, SR2, and SR3, were analysed using cluster analysis. Hierarchical cluster analysis (Hair et al. 1998; Manning & Munro 2007) was used to identify how often data was collected and reported while determining on each observation and belonging to each frequency group (not at all, monthly, quarterly, half yearly, and yearly). Then agglomerative methods of hierarchical cluster were employed to agglomerate all objects into individual clusters while minimizing similarities (final cluster) using the maximum distance of the complete linkage approach (Hair et al. 1998). So each object (environmental and social performance indicators) fell into its own cluster based on frequency depending on the nature of responses. The results of preliminary data analysis are interpreted below.
Table 1: Overall index of measurement indicators of environmental and social performance reporting

<table>
<thead>
<tr>
<th>Overall Index of measurement indicators</th>
<th>CI (%)</th>
<th>CE (%)</th>
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*CI = Current practice – internal reporting, CE= Current practice – external reporting, FI = Future intentions

Overall non-financial performance reporting for both current and in the future are summarised by the index of measurement indicators. Based on the indicator measures used in the survey, the maximum reportability index is 100% at which level a company reports on all indicators adopted by this study from the literature and Australian/international standards. Analysis shows that companies are at the lower end of scales currently but do significantly intend to measure costs of environment and social impacts in the future (Table1). Current reporting practices by companies appear to be biased towards reporting internally with less emphasis on external reporting (Gadenne & Zaman 2002; Gale 2005; IFAC 2005). Thus changing to a holistic accounting system that could support future intentions may help companies to more accurately report information on environment and social impacts for management decisions in relation to these impacts and to support environmental and social performance disclosures (Gadenne & Zaman 2002; Gray et al. 2001) while not substantially increasing reporting costs.

To analyse if there are any differences between environment and social measure being reported, the sample was further disaggregated into these two components. The environment indicators index shows that there are higher levels of reporting by some firms both internally and externally but a significant percentage do not report currently. This can tentatively be interpreted as companies showing concern about identifying and measuring environmental...
costs to support disclosures while having difficulty in capturing these costs, as they are hidden among production processes (IFAC 2005; UNDSD 2001). All firms indicated that they will report in the future (Table 2). Companies therefore will need to change their accounting systems in order to capture more accurate cost information to enhance management decision-making and disclosures (Berkel 2003; Gadenne & Zaman 2002). By changing accounting systems, firms could more efficiently evaluate reductions in environmental costs and contaminant such as wastes, emissions, and/or waste disposal thus reducing negative impacts on the environment and society (Burnett & Hansen 2008; Gale 2005).

Table 2: Environment measurement indicators index

<table>
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<th>Rank</th>
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<tr>
<td>No reporting</td>
<td>60</td>
<td>60</td>
<td>100%</td>
</tr>
</tbody>
</table>

*CI = Current practice – internal reporting, CE = Current practice – external reporting, and FI = Future intentions

Social indicators index reported by Australian manufacturing companies measure social costs and impacts of doing business (Table 3). Companies currently measure costs of social impacts and report internally at a higher level than environment impacts with only 20 % not reporting any measures currently and all reporting externally. This tentatively can be interpreted as manufacturing companies are significantly concerned about measuring social costs to improve social internal decision-making while supporting social performance disclosures (Gray 2001, 2006). For future intentions, companies wish to capture social costs to support social disclosers indicated by their responses that they place a higher priority over environmental measures. Again, companies need to change their accounting system for social
cost measurement in order to efficiently capture these costs for management decisions and to support social disclosures (Gray 2006; Richmond, Mook & Quarter 2003).

Table 3: Social measurement indicators index

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<th>Rank</th>
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<tr>
<td>No reporting 0</td>
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</tbody>
</table>

*CI = Current practice – internal reporting, CE= Current practice – external reporting, and FI = Future intentions

6. CONCLUSION

It is early days in this study to draw any evidenced-based conclusions so this paper will postulate what is expected from this study and the expected contributions. As a result of these tentative findings, manufacturing companies are intending to measure costs of environment and social impacts to meet requirements of environmental management accounting (EMA) (IFAC 2005; UNDSD 2001) and social management accounting (SMA) (Gray 2006; Gray et al. 2001) concepts and practices. Companies report these impacts internally and externally while creating cost information to enhance management decision-making and support disclosures (Burritt, Herzig & Tadeo 2009; Gadenne & Zaman 2002; Gale 2005; Gray 2006). Nonetheless, as environmental and social impact costs are hidden among production processes, companies are having difficulty in providing cost accounting information (Gale 2005; Sendroiu et al. 2006). Thus, changing accounting systems could help companies to fully cost products/services as well as create more accurate information to enhance management decisions and disclosures (Gray 2006; Gray et al. 2001). From this very preliminary analysis, Australian companies have a long way to go to meet world’s best practices and add value to be considered as sustainable organisations in the eyes of stakeholders and marketplaces. Further
qualitative data to be gathered will probe companies’ intentions so that this study can employ management accounting best practices adopted by companies in order to develop a sustainability management accounting system (SMAS) conceptual model.

An effective management accounting information system is required by manufacturing companies to efficiently measure costs of environment and social impacts. This is because there are increased concerns shown by companies’ stakeholders that require organisations to provide disclosures incorporating economic, social, and environmental performance in the form of triple bottom line reporting. Thus, developing a conceptual SMAS as proposed is an appropriate way to assist companies in their developments of a holistic management accounting system to support the demand of their stakeholders. Companies can then employ environmental and social information to enhance decision making and management of these costs as well as evaluating reductions in contaminants. With the right SMAS can also provide organisations with the ability to report energy consumption and emissions under NGER and meet requirements of GRI.

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